Each problem is worth 10 points. For full credit provide complete justification for your answers.

1. Write the 3\textsuperscript{rd} degree Maclaurin polynomial for $e^x$.

2. Determine whether $\sum_{n=1}^{\infty} \frac{1}{\sqrt{n}}$ converges or diverges.
3. Determine whether \( \sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{n}} \) converges or diverges.

4. Determine whether the series \( \sum_{k=1}^{\infty} \frac{k^2 - 1}{k^3 + 4} \) converges or diverges.
5. Determine whether the series \( \sum_{n=2}^{\infty} \frac{1}{n(\ln n)^2} \) converges or diverges.

6. Determine the radius of convergence of the power series \( \sum \left( \frac{x}{3} \right)^k \).
Help Biff (and his roommate!) by explaining clearly how we can find the sum of $\sum x^n$. 

Here's the explanation:

Given a series $\sum x^n$, we want to find its sum. For this problem, we have $x^n$ terms, where $x$ is a variable and $n$ is a non-negative integer. The sum of this series can be found using the formula for the sum of an infinite geometric series, provided the common ratio is between -1 and 1.

The formula for the sum of an infinite geometric series is:

$$S = \frac{a}{1 - r}$$

where $S$ is the sum of the series, $a$ is the first term (in this case, $x^0 = 1$), and $r$ is the common ratio (in this case, $x$).

So, the sum of the series $\sum x^n$ is:

$$\sum x^n = \frac{1}{1 - x}$$

provided $|x| < 1$.
8. Use a Taylor series with at least 4 nonzero terms to approximate $\sqrt{e}$. 
9. Use a Taylor series with at least 3 nonzero terms to approximate \( \int_0^{0.2} \sin(x^2) \, dx \).
10. Use a Taylor series to evaluate \( \lim_{x \to 0} \frac{x}{e^x - e^{-x}} \)
Extra Credit (5 points possible):

Find a power series representation for \( \ln \left( \frac{1 + x}{1 - x} \right) \).